DETAILED DESCRIPTION OF THE INVENTION

[042] The three hundred and twenty-seven differentially expressed cDNAs isolated from plant specimens of known developmental ages are disclosed in SEQ ID NOS: 1-327. The seven stage-specific promoters isolated from plant specimens are disclosed in SEQ ID NOS: 328-334. The discovery of these cDNAs and promoters enables the design, isolation, and construction of related nucleic acids, proteins, antigens, antibodies other heterologous genes. Both the cDNAs and promoters facilitate the staging, characterization, and manipulation of plant embyrogenesis, in particular, conifer embryogenesis. These molecules, and related nucleic acids, peptides, proteins, antigens, and antibodies are particularly useful when compiled into a relational database for the monitoring, design, selection, and cultivation of improved crop plants.

[043] The cDNAs of SEQ ID NOS: 1-327, in addition to the promoters of SEQ ID NOS: 328-334, were originally derived from Pinus taeda embryos, commonly known as the Loblolly Pine. Nevertheless, it is understood that the invention is applicable to and encompasses all plants, including all dicotyledonous plants, including all conifers, including all species of Pinus, Picea, and Pseudotsuga. Exemplary conifers may include Picea abies, and Psedotsuga menziesii, and Pinus taeda.

Nucleic Acid Molecules

[044] In a particular embodiment, the invention relates to certain isolated nucleotide sequences including those that are substantially free from contaminating endogenous material. The terms "nucleic acid" or "nucleic acid molecule" refer to a deoxyribonucleotide or ribonucleotide polymer in either single-or double-stranded form,

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and unless otherwise limited, would encompass known analogs of natural nucleotides that can function in a similar manner as naturally occurring nucleotides. A "nucleotide sequence" also refers to a polynucleotide molecule or oligonucleotide molecule in the form of a separate fragment or as a component of a larger nucleic acid. The nucleotide sequence or molecule may also be referred to as a "nucleotide probe." The nucleic acid molecules of the invention are derived from DNA or RNA isolated at least once in substantially pure form and in a quantity or concentration enabling identification, manipulation, and recovery of its component nucleotide sequence by standard biochemical methods. Examples of such methods, including methods for PCR protocols that may be used herein, are disclosed in Sambrook et al., *MoLecular Cloning: A Laboratory Manual,* 2nd ed., Cold Spring Harbor Laboratory, Cold Spring Harbor, NY (1989), *Current Protocols in Molecular Biology* edited by F.A. Ausubel et al., John Wiley and Sons, Inc. (1987), and Innis, M. et al., eds., *PCR Protocols: A Guide to Methods and Applications*, Academic Press (1990), each of which are herein incorporated by reference in their entirety.

[045] As used herein a "nucleotide probe" is defined as an oligonucleotide capable of binding to a target nucleic acid of complementary sequence through one or more types of chemical bonds, through complementary base pairing, or through hydrogen bond formation. As described above, the oligonucleotide probe may include natural (ie. A, G, C, or T) or modified bases (7-deazaguanosine, inosine, etc.). In addition, bases in a oligonucleotide probe may be joined by a linkage other than a phosphodiester bond, so long as it does not prevent hybridization. Thus,

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oligonucleotide probes may have constituent bases joined by peptide bonds rather than phosphodiester linkages.

[046] A "target nucleic acid" herein refers to a nucleic acid to which the nucleotide probe or molecule can specifically hybridize. The probe is designed to determine the presence or absence of the target nucleic acid, and the amount of target nucleic acid. The target nucleic acid has a sequence that is complementary to the nucleic acid sequence of the corresponding probe directed to the target. As recognized by one of skill in the art, the probe may also contain additional nucleic acids or other moieties, such as labels, which may not specifically hybridize to the target. The term target nucleic acid may refer to the specific nucleotide sequence of a larger nucleic acid to which the probe is directed or to the overall sequence (e.g., gene or mRNA) whose expression level it is desired to detect. One skilled in the art will recognize the full utility under various conditions.

[047] As described herein, the nucleic acid molecules of the invention include DNA in both single-stranded and double-stranded form, as well as the RNA complement thereof. DNA includes, for example, cDNA, genomic DNA, chemically synthesized DNA, DNA amplified by PCR, and combinations thereof. Genomic DNA, including translated, non-translated and control regions, may be isolated by conventional techniques, *e.g.,* using any one of the cDNAs of SEQ ID NO: 1 through SEQ ID NO: 327, or suitable fragments thereof, as a probe, to identify a piece of genomic DNA which can then be cloned using methods commonly known in the art. In general, nucleic acid molecules within the scope of the invention include sequences that hybridize to sequences of SEQ ID NOS: 1-334 under hybridization and wash conditions of 5°, 10°,

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